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# Evaluating the implementation of the Mayo-Portland adaptability inventory-4 (MPAI-4) in three rehabilitation settings in Quebec: A mixed-methods study protocol

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Keywords: Implementation, rehabilitation, Mayo-Portland adaptability inventory (MPAI-4), integrated knowledge translation, mixed studies

**Abstract:**

**Introduction:** Stroke is a leading cause of morbidity and mortality worldwide, placing an immense burden on patients and the health system. Timely access to rehabilitation services and the use of standardized outcome measures is endorsed for optimizing patient rehabilitation outcomes and improving clinical decision-making. This project results from a provincially mandated recommendation to use the fourth version of the Mayo-Portland Adaptability Inventory (MPAI-4) to measure changes in social participation of stroke survivors and to maintain commitment to evidence-informed practices in stroke care. This protocol outlines the implementation process of the MPAI-4 for three rehabilitation

centers. The objectives are to: i) describe the context of MPAI-4 implementation; ii) determine clinical teams' readiness for change; iii) identify barriers and enablers to implementing the MPAI-4 and match the implementation strategies; iv) evaluate the MPAI implementation outcomes including the degree of integration of the MPAI-4 into clinical practice, and v) explore participants' experiences using the MPAI-4.

**Methods and analysis:** We will use a multiple case study design within an integrated knowledge translation approach with active engagement from key informants. Each case is a rehabilitation centre implementing MPAI-4. We will collect data from clinicians and program managers using mixed methods guided by several theoretical frameworks. Data sources include surveys, focus groups and patient charts. We will conduct descriptive, correlational, and content analyses. Ultimately, we will analyze, integrate data from qualitative and quantitative components and report them within and across participating sites. Results will provide insights about integrated knowledge translation within stroke rehabilitation settings that could be applied to future research projects.

**Ethics and dissemination:** The project received Institutional Review Board approval from the Centre for Interdisciplinary Research in Rehabilitation of Greater Montreal. We will disseminate results in peer-reviewed publications and at local, national, and international scientific conferences.

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- We will conduct this study in three rehabilitation centers in Canada using an integrated knowledge translation approach with clinicians and managers to better understand the implementation context thereby optimising likelihood of implementation success.
- The identification of barriers and enablers of successful implementation of evidence-informed practices in rehabilitation settings may help strengthen rehabilitation service planning.

- The triangulation of data collection and analysis methods guided by implementation science frameworks will help optimize implementation success.
- The support of clinicians and managers in the uptake of evidence-informed practices will ultimately improve stroke survivors' outcomes.
- The two data collection methods (i.e., self-reported surveys and focus groups) may introduce some bias including missing data, social desirability, under or overestimation of the expected behavior.

## BACKGROUND

Stroke is one of the main causes of morbidity and mortality [1-4], affecting an estimated 11.9 million people and accounting for 4.4 million deaths worldwide in 2017 [5-7]. Stroke survivors experience sequelae [8], including depression [9], loss of motor function [10], and vision loss [11]. Health and social consequences negatively influence the quality of life of stroke survivors [12], placing a burden on family and friends when they return home [13], and resulting in an economic burden to society [12].

Given the incidence of stroke and its impacts, a growing body of evidence suggests timely access to rehabilitation services improves stroke symptoms, patients' well-being [14-16], functional independence and social participation [17-19]. There is also mounting evidence to support the clinical use of standardized outcome measures [20, 21] to support the improvement of individuals' function and participation [22, 23], enhance patient rehabilitation outcomes [24-26], facilitate a patient-centered approach [27], and maintain clinical excellence and commitment to evidence-informed practices [28, 29]. An outcome measure used for these purposes is the Mayo-Portland Adaptability Inventory - version 4 (MPAI-4) which can assess both inpatient and outpatient rehabilitation patients' functional abilities and status [30-33]. Worldwide government health authorities and organizations have incorporated the MPAI-4 as part of their recommended practices in rehabilitation care for survivors of acquired brain injury. For instance, the National Outcome Info Database (USA) [13] and The Quebec Ministry of Health (*Ministère de la Santé et des Services sociaux*; MSSS) [34] have mandated the use of MPAI-4 in their local contexts. However, as with many new practices, the implementation of the MPAI-4 in clinical settings can be complex, multi-level, and thus, difficult to achieve. The implementation strategies that are targeted to the local context [35-37] may help to promote the adoption of evidence-informed practices [38], to improve patient and provider experiences related to the quadruple aim framework [39, 40] and ultimately, to inform the implementation success.

This paper describes the protocol for a study that aims to evaluate the process of implementing the MPAI-4 using an integrated knowledge translation (iKT) approach [41], and evaluate its success (outcomes and impacts) in three stroke outpatient rehabilitation settings. IKT involves the engagement of stakeholders including managers and clinicians in each participating site in all the steps of the research process including the development of the research questions, selection of the study design and methodology, selection of outcome measures, data collection process, interpretation of the findings, dissemination of results [41, 42].

**The specific objectives are to**:

1. Describe the context in which each stroke rehabilitation site will implement the MPAI-4, and the potential strategies to improve implementation success.
2. Determine clinicians' readiness to adopt the MPAI-4 in each site and across stroke rehabilitation sites.
3. Identify barriers and enablers to implementing the MPAI-4 within and across the stroke rehabilitation sites, as well as select and tailor the implementation strategies.
4. Evaluate the MPAI-4 implementation outcomes (acceptability, appropriateness, feasibility, adoption, and fidelity), including the degree to which the MPAI-4 is integrated into routine clinical practice within and across sites.
5. Explore clinicians' and managers' experiences of using MPAI-4 within and across sites.

## METHODS

### Study design

We will use a longitudinal descriptive multiple case study design [43] to comprehensively explore a phenomenon (i.e., the implementation of the MPAI-4) in its natural context [44]. According to Yin [45, 46], a case can be a decision, a program, an implementation process, an organizational change, a person, an event, or an entity that is context-dependent. In this study, a case will be a healthcare institution with its own stroke rehabilitation program. We will work with clinicians and managers to codevelop and execute the implementation plan. The use mixed-methods within the multiple case study [47, 48] will provide a deeper understanding of the factors influencing the clinicians' uptake of MPAI-4 while capturing the breadth of process and impact on outcomes.

### Implementation setting and description of the case

The study is a multi-centre project within the outpatient stroke rehabilitation programs in three regional health authorities in Quebec, Canada. Although these healthcare institutions (i.e., cases) share the same goals in terms of rehabilitation services offered to a stroke clientele, they differ in the territory and population density served, organizational culture and climate. Each of the rehabilitation programs includes between 20 and 45 clinicians, from different disciplines, providing services to between 200-300 outpatients annually, of various age groups, living with motor, language and/or sensory limitations.

### Description of the fourth version of the Mayo-Portland Adaptability Inventory (MPAI-4)

The MPAI-4 is freely available in many languages including French (Canadian) [30, 49-51] with good psychometric properties as the responsiveness [52-54], the cross-cultural validity and the reliability [49, 50]. The MPAI-4 includes 29 items classified in three main subscales: the ability, adjustment and participation [55]. All MPAI items are scored on a 5-point Likert scale (0 – 4) where 0 represents no

limitations and 4 represents a severe issue interfering with activities more than 75% of the time. For interpretation, this Likert scale must be converted to T-scores, with higher T-scores indicating lower levels of functioning [30, 49-51].

**Patient and Public Involvement:** No patient involved in the project due to the COVID-10 pandemic and its challenges.

**Implementation process**

We will work with clinicians and managers to iteratively codevelop, adapt and execute the implementation plan for three major phases: pre-implementation, implementation and sustainability [56]. In this protocol we only focus on the first two phases. Implementation strategies will be suggested by the clinical teams from their perceived barriers and enablers. Additional strategies will be tailored based on barriers and enablers identified in each site as informed by the Consolidated Framework for Implementation Research (CFIR) [37, 57, 58], (Table 1), as well as by the Expert Recommendations for Implementing Change (ERIC) taxonomy [38]. The ERIC taxonomy is a compilation of implementation strategies aiming to support selection and reporting of strategies used to address the potential determinants of implementation [38, 59]. A summary of design and implementation process is available in figure 1.

**Table 1: Implementation process and strategies**

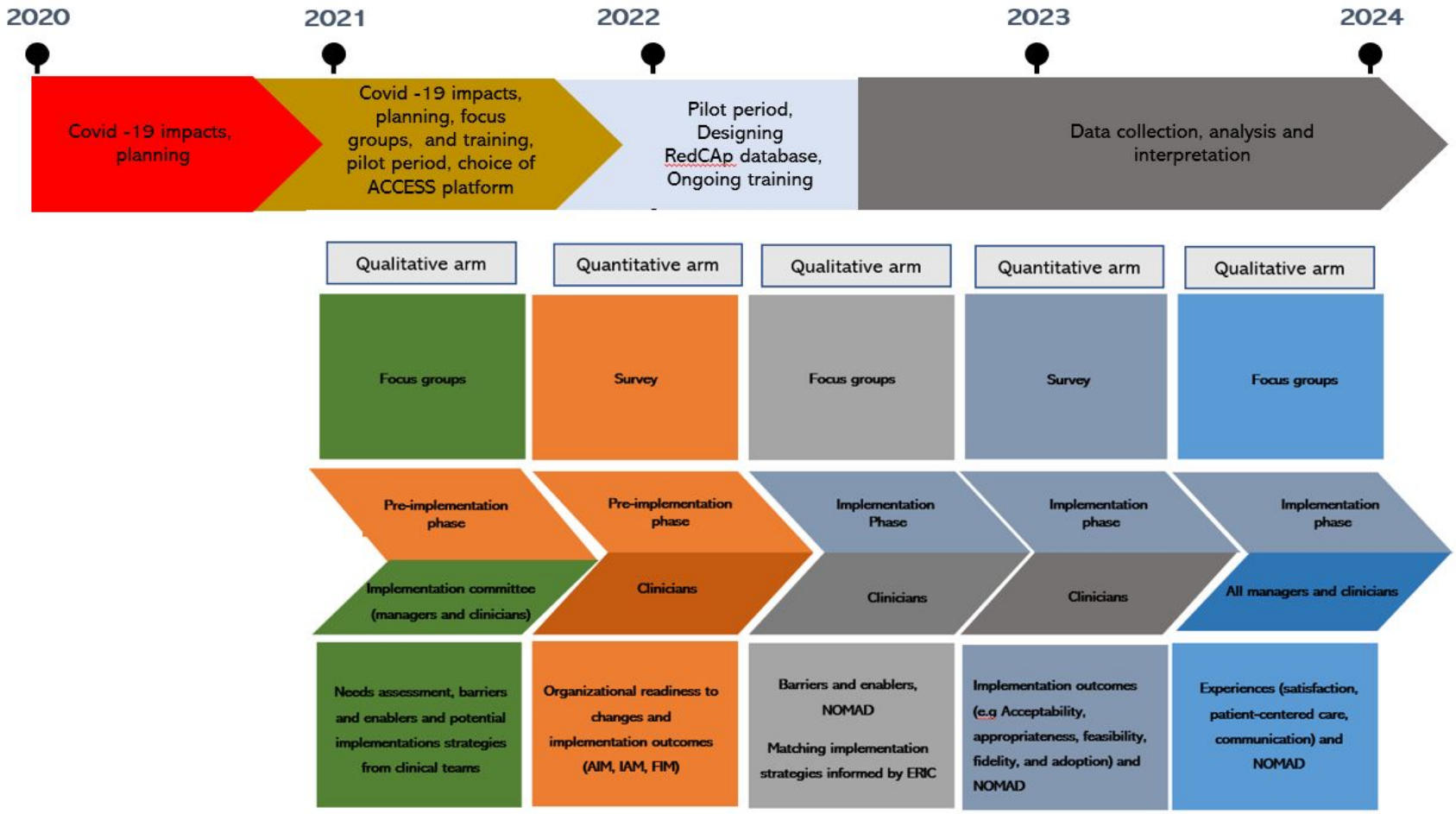
| Steps | Implementation Process | Approaches | Implementation strategies |
|---|---|---|---|
| Pre-implementation | Description of the context/Needs assessment (IT resources, human and materials resources) | Determine with the support of the managers all the members of local implementation committee<br>Meeting with IT team<br>Regular meetings with each local implementation committee<br>Choice and Adaptation to the electronic database ACCESS for the stroke program' needs<br>Number of clinicians and patients in each clinical program<br>Adaptations of the administration protocol of MPAI-4<br>Choice of participating programs in each site | • Facilitation strategies with an external facilitator who is a postdoctoral fellow with a great experience in knowledge translation and working in the clinical environments with various stakeholders including researchers, managers and patients. Another person with a facilitation role is an internal facilitator, member of the clinical team and of the local implementation committee, who works closely with the manager<br>• Local implementation committee composed of managers and clinical coordinators<br>• Inter-site implementation committee composed of managers and administrators<br>• Coach from traumatic brain injury (TBI) program<br>• Readiness survey<br>• Regular meetings with local implementation committee at each site (n=2 at least for all sites) to gain insights into the potential barriers and facilitators to implementing the MPAI-4, the technological aspects, the usability of MPAI-4<br>• Early implementation strategies as training, facilitation |
| | Training | Develop and adaptation of the training materials to each site (benefits, advantages, clinical utility, use, scoring and interpretation of MPAI-4 scores) | • Set up booster training sessions every three months for people who need and for the new members of the clinical team |

| | | |
|---|---|---|
| | Set up the training for instance virtual or in-person | |

**Table 1: Implementation process and strategies - Continued**

| Steps | Implementation process | Approaches | Implementation strategies |
|---|---|---|---|
| **Implementation phase** | Pilot | Adaptation to each site for the duration of the pilot step and expectations during this step for instance 2 completed MPAI by clinicians where we will have one electronic and another one in - person | • Adaptation to the administration protocol<br>• Strategies to address barriers and enablers<br>• Regular meetings with implementation committees<br>• Sustainability strategies with the committees |
| | Full Scale | Choice of the date and duration of this step<br>Define the expectations during this step for instance all clinicians will use the electronic version of MPAI<br>Adaptation of the administration protocol after the pilot | • Adaptation to the administration protocol after the pilot and various questions from clinical team |

**Figure 1: Implementation design and Timeline of MPAI-4 implementation project**



## Theoretical frameworks

Three theoretical frameworks will be used to guide the pre-implementation and implementation phases. The first framework is the CFIR [57, 58] which we will use it to identify barriers and facilitators. The CFIR is composed of five domains of context: characteristics of the innovation, inner setting, outer setting, the processes that influence the implementation of innovations and integration into clinical routines, and characteristics of individuals [57]. We will adapt questions from the interview guide tool proposed by Damschroder and colleagues (2009) [60] .

The second framework is Proctor et al.'s Implementation Outcomes Framework (IOF) [61]. It proposes a taxonomy of implementation outcomes, patient outcomes and health service outcomes. In the case of the present project, we will focus on selected implementation outcomes, including acceptability, appropriateness, adoption, feasibility, and fidelity.

Lastly, we will use the Normalization Process Theory (NPT) to explore how the MPAI-4 becomes embedded and integrated into usual practice [62-64]. NPT theorises on the ways that people make sense of the work for implementing a complex intervention [62, 64]. In alignment with NPT, four constructs play a central role in generating the work of implementation: coherence/sense-making, cognitive participation, collective action and reflexive monitoring items [62, 64]. We will use the NPT to: i) assess the progress toward normalization over time and ii) compare the normalization (progress or outcomes) between sites in an implementation project [65].

## Pre-implementation phase

This phase will consist of a local needs assessment to elicit information on available resources in each site (i.e., each case), clinicians' readiness to adopt the MPAI-4 and the relevant implementation strategies

that may aid in activating the clinicians' adoption of the MPAI-4 and, ultimately, the implementation outcomes (aims 1 & 2) [66]. This phase is informed by the two first theoretical frameworks such as CFIR and Implementation outcomes framework.

**Design:** A mixed method (Qual-Quant) [47, 48] design will be used in this phase. The qualitative descriptive approach is used to understand the stakeholders' perspectives of their local context [46], and to conduct an in-depth needs assessment of available resources in each site. The organizational and clinical teams' readiness will be evaluated with the quantitative component.

**Participants:** We will form two sets of committees: one local implementation committee composed of managers and clinicians/clinical coordinators at each of the three sites; and one inter-site implementation committee composed of managers/administrators from all participating sites. For the qualitative component, we will invite all members of the local implementation committees and members of the information technology (IT) service. For the quantitative component, we will recruit all clinicians from all professions in rehabilitation for instance occupational therapists, physical therapists, speech language pathologists...etc.

**Data collection:** Measure of readiness will be obtained from two sources: i) focus groups with clinical and information technology teams; and ii) survey including two questionnaires for clinicians. The managers of the respective rehabilitation programs will contact the participants via email.

**Focus groups:** In the focus group [67, 68], we will collect information about the local context including the composition of the clinical team and clinical process, clinicians' and managers' knowledge of the MPAI-4, their needs, expectations and goals, the available resources, the process of data collection, and their unique organizational challenges (objective 1). We will collect information on the potential implementation strategies to increase the clinicians' buy-in and adoption of MPAI-4 from their own perspectives. Focus groups with information technology teams will be used to understand the existing

patient care software systems, IT resources, and the IT requirement to improve the implementation success.

Two members of the research team (PKT and RA) will conduct a 60-minute focus group in person or virtually at each participating sites with members of the local implementation committee and IT members. We will develop the interview guide based on existing literature on MPAI-4 implementation [23, 30, 69, 70], the team's experience in this content area, and questions from the CFIR interview guide tool [57, 60]. Interviews will be audio-recorded and transcribed verbatim.

**Survey:** Quantitative data will be collected from a survey sent to all clinicians. The approximatively 15 minutes survey will be composed of questions related to two measurement tools such as the organizational Readiness for Implementing Change (ORIC) and the early implementation outcomes described below. Sociodemographic variables will be collected for instance gender, age group, site of work, profession. The survey will take approximatively 10 minutes to fill out each measure tool for a total of 20 minutes.

***Organizational Readiness for Implementing Change***

The ORIC is based on Weiner's organizational theory [71] and aims to evaluate the organization's readiness to implement change including its commitment to change and its change efficacy as perceived by its members, and to guide them in the identification of strategies and resources relevant to their context [72]. The survey will contain 10-items scored on a 5-point Likert scale, ranging from "Disagree" to "Agree" [73]. It has been translated in many languages including Canadian French where the validation process has been conducted in a rehabilitation setting [73]. French and English versions of this tool have good psychometric properties including content validity, construct validity, and reliability [73].

***Implementation outcomes: Acceptability of Intervention Measure (AIM), Intervention Appropriateness Measure (IAM), and Feasibility of Intervention Measure (FIM))***

There are three briefs, validated, pragmatic and reliable measures developed by Weiner and collaborators and related to Proctor et al.'s IOF [61, 74]. Each measure is composed of four items per construct with ordinal five response options (from "completely disagree" to "completely agree"), giving a total of 12 questions [74]. Cut-off scores for interpretation not yet available; however, higher scores indicate greater acceptability, appropriateness, or feasibility [74]. There is support for AIM, IAM and FIM psychometric properties including good inter-item reliability and test-retest reliability [74]. We will use the original English versions and a non-validated French translation of these measures because there is no French version of this tool.

**Data Analysis:** Two members of the research team (PKT and RA) will conduct a content analysis of the qualitative data [75] using N*Vivo software [76] and a quantitative data analysis using SAS version 12.1 [77]. They will anonymize the transcripts and review them for accuracy. Analysis will involve three phases [75]: 1) familiarize with the data; 2) organize the data with a categorization matrix; and, 3) report the data with the presentation of the described contents (meanings) of the categories and themes. Throughout this process, PKT and RA will meet regularly with one another and with the larger research team to discuss coding and potential recurring ideas and generate categories and themes as a part of a reflexive cycle. Any discrepancies will be resolved by discussion. Trustworthiness [78-80] will be supported through triangulation of data sources and collection methods (focus groups, meetings minutes, facilitators' notes, and surveys), using of multiple coders and several sites. Descriptive analyses of the quantitative data (e.g., mean, standard deviation, percentage) will be conducted to address variation in clinician readiness. We will explore the difference between sociodemographic variables of clinician readiness within and across sites. Qualitative and quantitative data will be integrated to further inform

the analysis as well as during the interpretation phase. We will use quotes to illustrate the most relevant findings from the qualitative data. We will generate tables with information on socio-demographic characteristics and from measurement tools.

**Anticipated Results:** Results from this mixed-methods within the multiple case study will help to: 1) shed light on clinicians' perceptions regarding the MPAI-4 and its compatibility with the clinical practice; and 2) inform and build a multicomponent implementation blueprint or plan of necessary resources tailored to the local contexts and to improve the implementation success. The identification of barriers and enablers informed by CFIR will guide the tailoring of the implementation strategies [59]. We will consider implementation strategies from clinical teams as well from ERIC after matching with identified barriers and enablers. These strategies will be ranked and prioritize by the research team and the local implementation committees, for strategies most likely to increase the clinicians' adoption of the MPAI-4 and to inform the next steps. The variation across the sites is expected to result in different adaptations to the MPAI-4 and/or implementation strategies to improve implementation success. Building on existing MPAI-4 materials used during previous implementation the MPAI-4 in traumatic brain injury rehabilitation settings [30, 51], we will develop the administration protocol of the MPAI-4 in each participating site (who, what, when, where and how).

**Implementation phase**

This phase will include two components: 1) a pilot period when each clinician administers the MPAI-4 to four/six patients per site over a time selected by each site, followed by adaptations based on clinicians' and managers' feedback; and 2) the full-scale implementation of the MPAI-4 across all sites (aims 3, 4 & 5). We will identify the barriers and enablers to the uptake of the MPAI-4 by clinical teams and

evaluate the implementation outcomes. A summary of outcomes is available in Table 2. This phase is informed by the three theoretical frameworks.

**Design:** A qualitative descriptive approach will be used to identify barriers and enablers, and the experiences of using MPAI-4. The level of integration of the MPAI-4 in the practices and the implementation outcomes will be determined using a quantitative component.

**Participants:** All managers and clinicians from each site will be invited to participate via email. We aim to recruit at least eight to ten clinicians, and one and/or two managers from each site to participate in focus groups. We will invite all clinicians to fill out the survey.

**Table 2: Process measures of implementation evaluation**

| Process results and measures | Method of data collection | Data analysis |
|---|---|---|
| Description of barriers and enablers of MPAI-4' implementation | Meetings minutes from local needs assessment<br>External and internal support field notes and site journal,<br><br>Focus groups with clinicians at 6 months (CFIR) | Content analysis |
| Description of the experiences with MPAI' implementation | Focus groups with clinicians and managers at 15 months | Content analysis |
| Description of the degree of normalization | Surveys (NOMAD) at 6, 12 and 15 months | Descriptive statistics |
| Feasibility:<br>1. Number of clinicians who used MPAI-4 and its subscales<br>2. Number of clinicians who interpret MPAI-4 and its subscales<br>3. Time taken to complete MPAI-4 and all its subscales<br>4. Time required to ACCESS/Redcap platform to a report<br>5. Numbers of reports downloaded and put in the patient charts | Access data<br>Self-report by clinicians<br>Field notes from external and internal support | Quantitative: Descriptive statistics<br>Qualitative: content analysis |
| Fidelity:<br>1. Number of missing subscales by clinicians<br>2. Number of missing case report forms<br>3. Reasons for missing data | Access data<br>Field notes from internal and external support | Quantitative: Descriptive statistics<br>Qualitative: content analysis |
| Acceptability:<br>1. % clinicians reporting MPAI-4 helpful in discussing symptoms/symptom management<br>2. % clinicians reporting ease of use and comprehensibility for MPAI-4 and technology systems | Surveys and self-report by clinicians<br>Field notes form internal and external support | Quantitative: Descriptive statistics<br>Qualitative: content analysis |

**Table 2: Process measures of implementation evaluation - Co**

| Outcomes measures | Method of data collection | Data analysis |
|---|---|---|
| Appropriateness:<br>1. % clinicians who find that MPAI-4 fit with workflow and clinical processes (e.g., MPAI-meaningful for clinical care, integrated in electronic health record system, linked clinical decision support)<br>2. MPAI-4 fit with clinic culture and values<br>3. The perceived relative advantage to use MPAI-4 (technology comfort, literacy level, meaningful for clinical condition) | Survey and self-reported by clinicians<br>Field notes from external and internal support - PDSA | Quantitative: descriptive statistics<br>Qualitative: content analysis |
| Fidelity:<br>1. Proportion of patients whose MPAI-4 was completed on expected times (admission, discharge, both)<br>2. % of targeted patients whose MPAI-4 was completed at the first individual intervention plan % of targeted patients whose MPAI was totally completed at discharge<br>3. Proportion of patients whose MPAI-4 scores were sent to the follow-up team, e.g., return-to-work program or CLSC<br>4. Proportion of targeted patients for whom the MPAI-4 was completed at discharge, so the total score decreased (improvement). | Access data | Quantitative: descriptive analysis |
| Adoption:<br><br>Number of clinicians who used MPAI-4 over time (9, 12 and 15 months post training) | Access data | Quantitative: descriptive analytics |
| Experiences/satisfaction/success<br>MPAI- inform the PII same it is not discussed with the patient | Focus groups<br>Field notes | Qualitative: content analysis |

**Data collection:** Data collection will occur at three timepoints: at 6-, 12-, and 15- months following the pilot period defined in each site, during the full-scale implementation phase. The collected data will include information about: i) barriers and enablers to use of MPAI-4; ii) integration of MPAI-4 into clinical practice; ii) implementation outcomes (acceptability, appropriateness, feasibility, fidelity and adoption); and iii) experiences of the MPAI-4 use (for instance communication within and across sites, predefined goal as organizational, reflexivity, patient-centered care, patient-outcomes, technical and technological issues).

Focus group questions will be used to identify the factors that influence the uptake of the MPAI-4. We will conduct two focus groups of 90-minutes each [68]: a first to identify the barriers and enablers with the clinicians, and a second to explore managers' and clinicians' experiences of using MPAI-4. We will pilot-test the interview guide with one clinician and/or one manager to ensure the clarity of questions and their comprehensiveness. The first interview guide will be composed of open-ended questions addressing different constructs of the CFIR framework such as inner and outer settings, planning strategies, individual characteristics, intervention characteristics.

The second interview guide will consist of open-ended questions addressing clinicians and managers' viewpoints on their experiences with the use of MPAI-4 during this period, the strategies deployed for its implementation, the level of integration of the MPAI into the patient's treatment plan, their level of satisfaction and the lessons learned. Managers and clinicians will be recruited by email by a member of the research team. Before the focus group, participants will be asked to complete a brief sociodemographic questionnaire. We will use a similar approach for the focus group in the qualitative arm for the pre-implementation phase.

We will use the screening of MPAI-4 data from patient charts and three online, auto-administrated, and anonymous surveys to collect information on the MPAI-4 integration across time and the implementation measures using the Normalisation Measure Development questionnaire (*NoMAD*) [62, 81].

We will report MPAI-4 data from patient charts at different periods of administration (admission and discharge).

Underpinned by NPT [82, 83], the 20-item NoMAD assesses the normalisation of complex healthcare interventions such as the MPAI-4. It consists of three parts: Part A: sociodemographic information, Part B collecting information about the current use and likelihood of using the intervention in the future, and Part C comprising 20 items on 5-point Likert scale (1=completely agree to 5=completely disagree). This instrument has satisfactory psychometrics properties in French and English including the construct validity and the reliability [62]. Several implementation process outcomes will be collected from patients' charts. We will send the surveys to all clinicians in each site at different timelines. They will take approximatively 15 minutes to fill out it.

**Data analysis:** We will analyze the quantitative and qualitative data separately. The qualitative data will be used to inform the next steps in the implementation, mainly for choosing and tailoring implementation strategies. Both the quantitative and qualitative data will inform the last qualitative data collection on participants' experiences of the MPAI-4 use.

The qualitative data will be analyzed using a hybrid deductive-inductive approach [84]. Themes will be derived from the CFIR [57] while still allowing for emerging categories. Quantitative data from the NoMAD will be analyzed using descriptive analyses (e.g., mean, standard deviation, percentage). Internal consistency of all theoretical measures will be evaluated using Cronbach's alpha with an acceptable threshold defined as 0.70 [85]. We will estimate the MPAI-4 subscale scores as well as the

overall score by data from patient charts. We will generate user progress reports by site, and across sites. We will generate tables or figures with information on socio-demographic characteristics. We will use quotes to illustrate the most relevant findings.

We will subsequently aggregate and integrate the data for a more comprehensive interpretation of the results. Triangulation across various data sources theoretical applications, data collection and data analysis techniques will be used to increase the depth of understanding of barriers and enablers to the uptake the MPAI-4 in stroke rehabilitation settings. We will highlight all areas of convergence and divergence across the participating rehabilitation sites.

**Anticipated Results:** This phase will generate a list of barriers and enablers, and potential tailored implementation strategies matched to reduce the barriers and enhance and maintain the enablers [59]. The data will help to understand: the current use, the likelihood of using the MPAI-4 in the future, clinicians' perceptions of the impact of MPAI-4 on their clinical practice, the perceived changes over the time, and whether it could become a routine part of practice.

## DISCUSSION

We propose that successful implementation of the MPAI-4 requires an IKT approach with active engagement from all stakeholders, including managers and clinicians in each of the participating clinical rehabilitation programs. This study has the potential to contribute to the advancement of knowledge regarding the implementation of the MPAI-4 by examining similarities and differences between sites, highlighting the influence of context in the success of implementation (or not) that may influence providers' experiences. The combination of multiple theoretical frameworks offers the opportunity to map the broad barriers and enablers influencing clinicians' adoption of MPAI-4 uptake, and to select

tailored strategies and to comprehensively measure the implementation processes and outcomes, including clinician's perceived clinical utility of MPAI-4 [69] as well as strategies that will increase the success of the MPAI-4's implementation in stroke rehabilitation programs.

The implementation process of the MPAI-4 will provide us with data to facilitate communication between clinical teams across the care continuum. It will strengthen patient-centered practice and improve patient outcomes with the goal of optimizing social participation. This study will enhance the clinical utility of the MPAI-4 in stroke. Ultimately, we will conduct a comparison of our results on determinants with those of previous studies conducted with TBI patients [22, 30, 86]. Results of this study will provide insights about IKT approach within stroke rehabilitation settings that could be applied to future research projects.

Despite the valuable insights that may be gained from this study, there are some limitations. Mixed methods with many data sources such as self-reported questionnaires, patient charts and focus groups may introduce response bias, that is, an under or overestimation of the expected behavior. To overcome this challenge, we will use triangulation across data sources, various theoretical applications, different methods of analysis and clinical teams' involvement to increase the in-depth understanding of our data

**Ethics and dissemination**

The project has received the Institutional Review Board (IRB) approval of CRIR (CRIR 1523-0221/MP-50-2022-968). Any protocol modifications will be submitted for approval to the IRB, prior to implementation. The project will be conducted from 2022 to 2024.

The dissemination plan will be developed with the implementation team in each site. The iKT approach (participatory approach, reflective approach, local team) will allow for ongoing knowledge exchange

within and between participating sites. In addition, we will disseminate results in peer-reviewed publications and at local, national, and international scientific conferences/workshops. Reporting of this study will seek to satisfy the standards of Good Reporting of a Mixed Methods Study [87] and the Standards for Reporting Implementation Studies [88, 89].

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BMJ Open

# Evaluating the implementation of the Mayo-Portland adaptability inventory-4 (MPAI-4) in three rehabilitation settings in Quebec: A mixed-methods study protocol

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| | |

# Evaluating the implementation of the Mayo-Portland adaptability inventory-4 (MPAI-4) in three rehabilitation settings in Quebec: A mixed-methods study protocol

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Keywords: Implementation, rehabilitation, Mayo-Portland Adaptability Inventory (MPAI-4), integrated knowledge translation, mixed studies

**Abstract:**

**Introduction:** Stroke is a leading cause of morbidity and mortality worldwide, placing an immense burden on patients and the health system. Timely access to rehabilitation services can improve stroke survivors' quality of life. The use of standardized outcome measures is endorsed for optimizing patient rehabilitation outcomes and improving clinical decision-making. This project results from a provincially mandated recommendation to use the fourth version of the Mayo-Portland Adaptability Inventory (MPAI-4) to measure changes in social participation of stroke survivors and to maintain commitment to evidence-informed practices in stroke care. This protocol outlines the implementation process of the MPAI-4 for three rehabilitation centers. The objectives are to: i) describe the context of MPAI-4 implementation; ii) determine clinical teams' readiness for change; iii) identify barriers and enablers to implementing the MPAI-4 and match the implementation strategies; iv) evaluate the MPAI-4 implementation outcomes including the degree of integration of the MPAI-4 into clinical practice, and v) explore participants' experiences using the MPAI-4.

**Methods and analysis:** We will use a multiple case study design within an integrated knowledge translation approach with active engagement from key informants. Each case is a rehabilitation centre implementing MPAI-4. We will collect data from clinicians and program managers using mixed methods guided by several theoretical frameworks. Data sources include surveys, focus groups and patient charts. We will conduct descriptive, correlational, and content analyses. Ultimately, we will analyze, integrate data from qualitative and quantitative components and report them within and across participating sites. Results will provide insights about integrated knowledge translation within stroke rehabilitation settings that could be applied to future research projects.

**Ethics and dissemination:** The project received Institutional Review Board approval from the Centre for Interdisciplinary Research in Rehabilitation of Greater Montreal. We will disseminate results in peer-reviewed publications and at local, national, and international scientific conferences.

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- The study will use an integrated knowledge translation approach with clinicians and managers in rehabilitation centres.
- The identification of the barriers and enablers for the successful implementation of MPAI-4 may help to better understand the implementation context.
- The use of mixed-methods within the multiple case study will provide a deeper understanding of the factors influencing the clinicians' use of MPAI-4.
- The triangulation of data collection and analysis methods guided by implementation science frameworks will help in optimizing implementation success.
- The two data collection methods (i.e., self-reported surveys and focus groups) may introduce some bias.

## BACKGROUND

Stroke is one of the main causes of morbidity and mortality [1-4], affecting an estimated 11.9 million people, and accounting for 4.4 million deaths worldwide in 2017 [5-7]. Stroke survivors experience sequelae [8], including depression [9], loss of motor function [10], and vision loss [11]. Health and social consequences negatively influence the quality of life of stroke survivors [12], placing a burden on their family and friends when they return home [13], and resulting in an economic burden to society [12].

Given the incidence of stroke and its impacts, a growing body of evidence suggests timely access to rehabilitation services improves stroke symptoms, patients' well-being [14-16], functional independence and social participation [17-19]. There is also mounting evidence to support the clinical use of standardized outcome measures [20, 21] to support the improvement of individuals' function and participation [22, 23], enhance patient rehabilitation outcomes [24-26], facilitate a patient-centered approach [27], and maintain clinical excellence and commitment to evidence-informed practices [28, 29]. An outcome measure used for these purposes is the Mayo-Portland Adaptability Inventory - version 4 (MPAI-4) which can assess both inpatient and outpatient rehabilitation patients' functional abilities and status [30-33]. Worldwide government health authorities and organizations have incorporated the MPAI-4 as part of their recommended practices in rehabilitation care for survivors of acquired brain injury. For instance, the National Outcome Info Database (USA) [13] and the Quebec Ministry of Health (*Ministère de la Santé et des Services sociaux*; MSSS) [34] have mandated the use of MPAI-4 in their local contexts. However, as with many new practices, the implementation of the MPAI-4 in clinical settings can be complex, multi-level, and thus, difficult to achieve. The implementation strategies that are targeted to the local context [35-37] may help to promote the adoption of evidence-informed practices [38], to improve patient and provider experiences related to the Quadruple aim framework [39, 40] and ultimately, to inform the implementation success. In fact, the Quadruple aim framework describes the importance of health care improvements and transformation efforts of the health care system, including

improving the health of populations, patients' experience of care, health care providers' experience and reducing the cost of care with the intention of improving health equity.

This paper describes the protocol for a study that aims to evaluate the process of implementing the MPAI-4 using an integrated knowledge translation (iKT) approach [41], and to evaluate its success (outcomes and impacts) in three stroke outpatient rehabilitation settings. IKT involves the engagement of stakeholders including managers and clinicians in each participating site in all the steps of the research process including the development of the research questions, selection of the study design and methodology, selection of the outcome measures, data collection process, interpretation of the findings, and dissemination of the results [41, 42].

**The specific objectives are to**:

1. Describe the context in which each stroke rehabilitation site will implement the MPAI-4, and the potential strategies to improve implementation success.
2. Determine clinicians' readiness to adopt the MPAI-4 in each site and across stroke rehabilitation sites.
3. Identify barriers and enablers to implementing the MPAI-4 within and across the stroke rehabilitation sites, as well as select and tailor the implementation strategies.
4. Evaluate the MPAI-4 implementation outcomes (acceptability, appropriateness, feasibility, adoption, and fidelity), including the degree to which the MPAI-4 is integrated into routine clinical practice within and across sites.

   Explore clinicians' and managers' experiences of using MPAI-4 within and across sites.

## METHODS

### Study design

We will use a longitudinal descriptive multiple case study design [43] to comprehensively explore a phenomenon (i.e., the implementation of the MPAI-4) in its natural context [44]. According to Yin [45, 46], a case can be a decision, a program, an implementation process, an organizational change, a person, an event, or an entity that is context-dependent. In this study, a case will be a healthcare institution with its own stroke rehabilitation program. We will work with clinicians and managers to codevelop and execute the implementation plan. The use of mixed-methods within the multiple case study [47, 48] will provide a deeper understanding of the factors influencing clinicians' use of MPAI-4 while capturing the breadth of the process and the impact on outcomes.

### Implementation setting and description of the case

The study is a multi-centre project within the outpatient stroke rehabilitation programs in three regional health authorities in Quebec, Canada. Although these healthcare institutions (i.e., cases) share the same goals in terms of rehabilitation services offered to a stroke clientele, they differ in the territory and the population density served, and the organizational culture and climate. Each of the rehabilitation programs includes between 20 and 45 clinicians, from different disciplines, providing services to between 200-300 outpatients annually of various age groups, living with motor, language and/or sensory limitations.

### Description of the fourth version of the Mayo-Portland Adaptability Inventory (MPAI-4)

The MPAI-4 is freely available in many languages including French (Canadian) [30, 49-51], with generally high quality evidence of strong psychometric properties [52] including responsiveness (defined as the ability of the MPAI-4 to detect changes in a patient in rehabilitation over time) [53-55], cross-

cultural validity and reliability [49, 50]. The MPAI-4 includes 29 items classified in three main subscales: ability, adjustment and participation [56]. All MPAI-4 items are scored on a 5-point Likert scale (0 – 4) where 0 represents no limitations and 4 represents a severe issue interfering with activities more than 75% of the time. For interpretation, this Likert scale must be converted to T-scores, with higher T-scores indicating lower levels of functioning [30, 49-51].

**Patient/ Public Involvement:** There was no patient involvement in the project design and development of the protocol due to the COVID-19 pandemic and its challenges. However, the patients will be involved in the implementation project as they will be assessed using the MPAI-4 by the clinicians as part of routine rehabilitation care. There is no expected research data collection with patients on the implementation process and the use of MPAI-4 results in the clinical decision-making. However, the original funding included a budget for compensating patient partners.

## Implementation process

We will work with clinicians and managers to iteratively codevelop, adapt, and execute the implementation plan for three major phases: pre-implementation, implementation and sustainability [57]. In this protocol we only focus on the first two phases. The study will last from June 2020 to December 2023 (Figure 1). The implementation strategies will be suggested by the clinical teams based on their perceived barriers and enablers during the pre-implementation phase. Additional strategies will be tailored based on the barriers and enablers identified in each site as informed by the Consolidated Framework for Implementation Research (CFIR) [37, 58, 59], (Table 1), as well as by the Expert Recommendations for Implementing Change (ERIC) taxonomy [38] during the implementation phase. The ERIC taxonomy is a compilation of implementation strategies aiming to support selection and

reporting of strategies used to address the potential determinants of implementation [38, 60]. A summary of design and implementation process is available in figure 1.

**Table 1: Implementation process and strategies**

| Steps | Implementation process | Approaches | Implementation strategies |
|---|---|---|---|
| Pre-implementation | Description of the context/Needs assessment (IT resources, human and materials resources) | Involvement of managers and all the members of local implementation committee.<br>Meeting with IT team<br>Regular meetings with each local implementation committee<br>Identification and adaptation to the electronic database<br>Access for the stroke program' needs<br>Number of clinicians and patients in each clinical program<br>Adaptations of the administration protocol of MPAI-4<br>Identification of participation in programs in each site | • Facilitation strategies with an external facilitator who is a postdoctoral fellow with extensive experience in knowledge translation and working in the clinical environment with various stakeholders including researchers, managers and patients (more than eight years working with the clinical teams). Another person with a facilitation role is an internal facilitator, member of the clinical team and of the local implementation committee, who works closely with the manager<br>• Local implementation committee composed of managers and clinical coordinators<br>• Inter-site implementation committee composed of managers and administrators<br>• Coach from traumatic brain injury (TBI) program<br>• Readiness survey<br>• Regular meetings with local implementation committee at each site (n=2 at least for all sites) to gain insights into the potential barriers and facilitators to implementing the MPAI-4, the technological aspects, the usability of MPAI-4<br>• Early implementation strategies as training, facilitation |
| | Training | Development and adaptation of the training materials to each site (benefits, advantages, clinical utility, use, scoring and interpretation of MPAI-4 scores) | • Set up booster training sessions every three months for people who need and for the new members of the clinical team |

| | | | |
|---|---|---|---|
| | | Set up the training for instance virtual or in-person | |

**Table 1: Implementation process and strategies - Continued**

| Steps | Implementation process | Approaches | Implementation strategies |
|---|---|---|---|
| **Implementation phase** | Pilot | Adaptation to each site for the duration of the pilot step.<br><br>In-person or electronic administration of the MPAI-4 | Adaptation to the administration protocol<br><br>Strategies to address barriers and enablers<br><br>Regular meetings with implementation committees<br><br>Sustainability strategies with the committees |
| | Main study | Defining the date and duration of this step<br><br>Defining the expectations during this step for instance all clinicians will use the electronic version of MPAI-4<br><br>Adaptation of the administration protocol after the pilot | Adaptation to the administration protocol after the pilot and various questions from clinical team |

## Theoretical frameworks

Three theoretical frameworks will be used to guide the pre-implementation and implementation phases. The first framework is the CFIR [58, 59] which we will use it to identify barriers and facilitators. The CFIR is composed of five domains of context: characteristics of the innovation, inner setting, outer setting, the processes that influence the implementation of innovations and integration into clinical routines, and characteristics of individuals [58]. We will adapt questions from the interview guide tool proposed by Damschroder and colleagues (2009) [61].

The second framework is Proctor et al.'s Implementation Outcomes Framework (IOF) [62]. It proposes a taxonomy of implementation outcomes, patient outcomes and health service outcomes. In the case of the present project, we will focus on selected implementation outcomes, including acceptability, appropriateness, adoption, feasibility, and fidelity.

Lastly, we will use the Normalization Process Theory (NPT) to explore how the MPAI-4 becomes embedded and integrated into usual practice [63-65]. NPT theorises on the ways that people make sense of the work for implementing a complex intervention [63, 65]. In alignment with NPT, four constructs play a central role in the process of implementation: coherence/sense-making, cognitive participation, collective action and reflexive monitoring [63, 65]. We will use NPT to: i) assess progress toward normalization over time and ii) compare normalization (progress or outcomes) between sites in an implementation project [66].

## Pre-implementation phase

This phase will consist of a local needs assessment to elicit the information on the available resources in each site (i.e., each case), the clinicians' readiness to adopt the MPAI-4 and the relevant implementation strategies that may aid in activating the clinicians' adoption of the MPAI-4 and, ultimately, the implementation outcomes (objectives 1 & 2) [67]. This phase is informed by the two first theoretical frameworks, CFIR and the IOF.

**Design:** A mixed methods (Qual-Quant) design [47, 48] will be used in this phase. A qualitative descriptive approach will be used to understand the stakeholders' perspectives of their local context [46], and to conduct an in-depth needs assessment of available resources in each site. The organizational and clinical teams' readiness will be evaluated with the quantitative component.

**Participants:** We will form two committees: one local implementation committee composed of managers and clinicians/clinical coordinators at each of the three sites; and one inter-site implementation committee composed of managers/administrators from all participating sites. For the qualitative component, we will invite all members of the local implementation committees and members of the information technology (IT) services to participate. For the quantitative component, we will recruit clinicians from all professions in participating sites who can administer the MPAI-4 after its implementation, including for instance occupational therapists, physical therapists, psychologists, kinesiologists, social workers, and speech-language pathologists.

**Data collection:** Information on readiness will be obtained from two sources: i) focus groups with clinical and information technology teams; and ii) a survey including two questionnaires for clinicians. The managers of the respective rehabilitation programs will contact the participants via email.

**Focus groups:** In the focus group [68, 69], we will collect information about the local context including the composition of the clinical team and clinical process, clinicians' and managers' knowledge of the MPAI-4, their needs, expectations and goals, the available resources, the process of data collection, and their unique organizational challenges (objective 1). We will collect information on the potential implementation strategies to increase the clinicians' buy-in and adoption of MPAI-4 from their own perspectives. Focus groups with information technology will be used to understand the existing patient care software systems, IT resources, and the IT requirements to improve the implementation success. Two members of the research team (PKT and RA) will conduct a 60-minute focus group in-person or virtually at each participating site with the members of the local implementation committee and IT members. We will develop the interview guide based on the existing literature on MPAI-4 implementation [23, 30, 70, 71], the team's experience in this content area, and the questions from the CFIR interview guide tool [58, 61]. Interviews will be audio-recorded and transcribed verbatim.

**Survey:** Quantitative data will be collected from a survey sent to all clinicians. The survey will be in English or French and will include Organizational Readiness for Implementing Change (ORIC) and the implementation outcomes measures described below. Sociodemographic variables will be collected including gender, age, clinical site, profession and number years of practice. Participants will need approximately 20 minutes to complete the survey.

***Organizational Readiness for Implementing Change***

The ORIC is based on Weiner's organizational theory [72], and aims to evaluate the organization's readiness to implement change, including its commitment to change and its change efficacy as perceived by its members. It will also be used to guide the clinicians in identifying the strategies and resources relevant to their context [73]. The survey will contain 10 items scored on a 5-point Likert scale, ranging

from "Disagree" to "Agree" [74]. It was translated into many languages including Canadian French where the validation process has been conducted in a rehabilitation setting [74]. French and English versions of this tool have good psychometric properties including content validity, construct validity, and reliability [74]. We will use both English and French versions in the study to offer clinicians the opportunity to use the tool in their preferred language.

***Implementation outcomes: Acceptability of Intervention Measure (AIM), Intervention Appropriateness Measure (IAM), and Feasibility of Intervention Measure (FIM))***

These are three brief, validated, pragmatic and reliable measures developed by Weiner and collaborators and related to Proctor et al.'s IOF [62, 75]. Each measure has four items per construct with ordinal five response options (from "completely disagree" to "completely agree"), for a total of 12 questions [75]. Cut-off scores for interpretation are not yet available; however, we will consider the mean value as in many other studies using these measures [76, 77]. As a result, the higher scores will indicate greater acceptability, appropriateness, or feasibility [75]. AIM, IAM and FIM have satisfactory psychometric properties including good inter-item reliability and test-retest reliability [75]. We will use the original English version and a non-validated French translation of these measures because there is no French version of this tool.

**Data Analysis:** Two members of the research team (PKT and RA) will conduct a content analysis of the qualitative data [78] using N*Vivo software (version 12) [79] and a quantitative data analysis using SAS version 12.1 [80]. They will anonymize the transcripts and review them for accuracy. Analysis will involve three phases [78]: 1) familiarizing with the data; 2) organizing the data with a categorization matrix; and, 3) reporting the data with the presentation of the described contents (meanings) of the categories and themes. Throughout this process, PKT and RA will meet regularly with one another and

with the larger research team to discuss coding and potential recurring ideas and generate categories and themes as a part of a reflexive cycle. Any discrepancies will be resolved by discussion. Trustworthiness [81-83] will be supported through triangulation of data sources and collection methods (focus groups, meetings minutes, facilitators' notes, and surveys), using of multiple coders and several sites. Descriptive analyses of the quantitative data (e.g., mean, standard deviation, percentage) will be conducted to address variation in clinician readiness. We will explore the differences between sociodemographic variables of clinician readiness within and across sites. Qualitative and quantitative data will be integrated to further inform the analysis as well as during the interpretation phase. We will use quotes to illustrate the most relevant findings from the qualitative data. We will generate tables with information on socio-demographic characteristics and from measurement tools.

**Anticipated Results:** Results from this mixed-methods design within the multiple case study will help to: 1) shed light on clinicians' perceptions regarding the MPAI-4 and its compatibility with the clinical practice; and 2) inform and build a multicomponent implementation blueprint, or plan of necessary resources tailored to the local contexts and to improve the implementation success. The identification of the barriers and enablers informed by CFIR will guide the tailoring of the implementation strategies [60]. We will consider implementation strategies from clinical teams as well as from ERIC after matching with the identified barriers and enablers. These strategies will be ranked and prioritize by the research team and the local implementation committees, to identify the strategies most likely to increase the clinicians' adoption of the MPAI-4 and to inform the next steps. The variation across the sites is expected to result in different adaptations to the MPAI-4 and/or implementation strategies to improve implementation success. Building on existing MPAI-4 materials used during the previous implementation of the MPAI-4 in traumatic brain injury rehabilitation settings [30, 51], we will develop the administration protocol of the MPAI-4 in each participating site (who, what, when, where and how).

**Implementation phase**

This phase will include two components: 1) a pilot period when each clinician administers the MPAI-4 to four/six patients per site over a time selected by each site, followed by adaptations based on clinicians' and managers' feedback; and 2) a main study implementation of the MPAI-4 across all sites (objectives 3, 4 & 5). We will identify the barriers and enablers to the use of the MPAI-4 by clinical teams and evaluate the implementation outcomes. A summary of outcomes is available in Table 2. This phase is informed by the three theoretical frameworks as CFIR, IOF, and NPT.

**Table 2: Process measures of implementation evaluation**

| Process results and measures | Method of data collection | Data analysis |
|---|---|---|
| Description of barriers and enablers of MPAI-4' implementation | Meetings minutes from local needs assessment<br>External and internal support field notes and site journal,<br>Focus groups with clinicians at 6 months (CFIR) | Content analysis |
| Description of the experiences with MPAI-4' implementation | Focus groups with clinicians and managers at 15 months | Content analysis |
| Description of the degree of normalization | Surveys (NoMAD) at 6, 12 and 15 months | Descriptive statistics |
| Feasibility:<br>1. Number of clinicians who used MPAI-4 and its subscales<br>2. Number of clinicians who interpret MPAI-4 and its subscales<br>3. Time taken to complete MPAI-4 and all its subscales<br>4. Time required to ACCESS/Redcap platform to a report<br>5. Numbers of reports downloaded and put in the patient charts | Access data/Patient charts<br>Self-report by clinicians<br>Field notes from external and internal support | Quantitative: Descriptive statistics<br>Qualitative: content analysis |
| Fidelity:<br>1. Number of missing subscales by clinicians<br>2. Number of missing case report forms<br>3. Reasons for missing data | Access data/Patient charts<br>Field notes from internal and external support | Quantitative: Descriptive statistics<br>Qualitative: content analysis |
| Acceptability:<br>1. % clinicians reporting MPAI-4 helpful in discussing symptoms/symptom management<br>2. % clinicians reporting ease of use and comprehensibility for MPAI-4 and technology systems | Surveys and self-report by clinicians<br>Field notes form internal and external support | Quantitative: Descriptive statistics<br>Qualitative: content analysis |

**Table 2: Process measures of implementation evaluation - Continued**

| Outcomes measures | Method of data collection | Data analysis |
|---|---|---|
| Appropriateness:<br>1. % clinicians who find that MPAI-4 fit with workflow and clinical processes (e.g., MPAI-4-meaningful for clinical care, integrated in electronic health record system, linked clinical decision support)<br>2. MPAI-4 fit with clinic culture and values<br>3. The perceived relative advantage to use MPAI-4 (technology comfort, literacy level, meaningful for clinical condition) | Survey and self-reported by clinicians<br>Field notes from external and internal support | Quantitative: descriptive statistics<br>Qualitative: content analysis |
| Fidelity:<br>1. Proportion of patients whose MPAI-4 was completed on expected times (admission, discharge, both)<br>2. % of targeted patients whose MPAI-4 was completed at the first individual intervention plan % of targeted patients whose MPAI-4 was completed at discharge<br>3. Proportion of patients whose MPAI-4 scores were sent to the follow-up team, e.g., return-to-work program or CLSC<br>4. Proportion of targeted patients for whom the MPAI-4 was completed at discharge, so the total score decreased (improvement, minimal important difference and robust important difference). | Access data/Patient charts | Quantitative: descriptive analysis |
| Adoption:<br>Number of clinicians who used MPAI-4 over time (6, 12 and 15 months post training) | Access data/Patient charts | Quantitative: descriptive analytics |
| Experiences/satisfaction/success<br>MPAI-4 informs the individual intervention plan even though it is not discussed with the patients | Focus groups<br>Field notes | Qualitative: content analysis |

**Design:** A qualitative descriptive approach will be used to identify the barriers and enablers, and the experiences of using MPAI-4. The level of integration of the MPAI-4 in the practices and the implementation outcomes will be determined by using a quantitative component.

**Participants:** All managers and clinicians from each site will be invited to participate via email. We aim to recruit at least eight to ten clinicians, and one and/or two managers from each site to participate in focus groups. We will invite all the clinicians to fill out the survey.

**Data collection:** We will use three data collection methods: i) focus groups; ii) patients' charts; and iii) surveys. Data collection will occur at three time points: at 6-, 12-, and 15- months following the pilot period defined in each site, during the main study implementation phase. The collected data will include information about: i) barriers and enablers to the use of MPAI-4; ii) integration of the MPAI-4 into clinical practice; ii) implementation outcomes (acceptability, appropriateness, feasibility, fidelity and adoption); and iii) experiences of the MPAI-4 use (for instance: communication within and across sites, predefined goal as organizational, reflexivity, patient-centered care, patient-outcomes, technical and technological issues).

**Focus group** questions will be used to identify the factors that influence the use of the MPAI-4. We will conduct two focus groups of 90-minutes each [69]: the first, to identify the barriers and enablers with the clinicians, and the second, to explore managers' and clinicians' experiences of using MPAI-4. We will pilot-test the interview guide with one clinician and/or one manager to ensure the clarity of questions and their comprehensiveness. The first interview guide will be composed of open-ended questions addressing

different constructs of the CFIR framework such as inner and outer settings, planning strategies, individual characteristics, and intervention characteristics.

The second interview guide will consist of open-ended questions addressing clinicians and managers' viewpoints of their experiences with the use of MPAI-4 during this period**,** the strategies deployed for its implementation, the level of integration of the MPAI into the patient's treatment plan, their level of satisfaction, and the lessons learned. Managers and clinicians will be recruited by email by a member of the research team. Before the focus group, participants will be asked to complete a brief sociodemographic questionnaire. We will use a similar approach for the focus group in the qualitative arm for the pre-implementation phase.

**Patients' charts:** We will report MPAI-4 data from patient charts at two periods of administration (admission and discharge). Several implementation process outcomes such as fidelity, feasibility and adoption will be collected from patients' charts. For instance, we will collect data on the number/percentage of clinicians who have used the MPAI-4 at the admission, the discharge or both; all its subscales; the missing subscales; the number of clients with whom the clinicians used the MPAI-4 (See Table 2).

**Survey:** We will use a 15-minute online, auto-administrated, and anonymous survey administered to all clinicians at each of the three time points to collect information on the MPAI-4 integration over time [63, 84]. The survey includes three parts. Part A: sociodemographic information; Part B: Information about the current use and the outcomes of implementation efforts. Part C is comprised of 20 items on a 5-point Likert scale (1=completely agree to 5=completely disagree) from Normalisation Measure Development questionnaire (*NoMAD*) [85, 86], and assesses staff perceptions of the factors relevant to embedding the

MPAI-4 in their clinical practice. This instrument has satisfactory psychometrics properties in French and English including the construct validity and the reliability [63].

**Data analysis:** We will analyze the quantitative and qualitative data separately. The qualitative data will be used to inform the next steps in the implementation, mainly for choosing and tailoring implementation strategies. Both the quantitative and qualitative data will inform the last qualitative data collection on participants' experiences of the MPAI-4 use.

The qualitative data will be analyzed using a hybrid deductive-inductive approach [87]. Themes will be derived from the CFIR [58] while still allowing for emerging categories. Quantitative data from the NoMAD will be analyzed using descriptive analyses (e.g., mean, standard deviation, percentage). Internal consistency of all theoretical measures will be evaluated using Cronbach's alpha with an acceptable threshold defined as 0.70 [88]. We will estimate the MPAI-4 subscale scores, as well as the overall score by data from patients' charts. We will generate the user progress reports for each site, and across sites. We will generate tables or figures with information on clinicians' socio-demographic characteristics. We will use quotes to illustrate the most relevant findings.

We will subsequently aggregate and integrate the data for a more comprehensive interpretation of the results. Triangulation across various data sources, theoretical applications, data collection and data analysis techniques will be used to increase the depth of understanding of the barriers and enablers to the use of the MPAI-4 in stroke rehabilitation settings. We will highlight all areas of convergence and divergence across the participating rehabilitation sites.

**Anticipated Results:** This phase will generate a list of identified barriers and enablers, and potential tailored implementation strategies matched to reduce the barriers, and enhance and maintain the enablers

[60]. The data will help to understand: current MPAI-4 use and the likelihood of using the MPAI-4 in the future, clinicians' perceptions of the impact of MPAI-4 on their clinical practice, the perceived changes over the time, and whether it could become a routine part of practice.

Timeline: This study was started in June 2020 and is estimated to end in December 2023. A detailed timeline is provided in Figure 1.

## DISCUSSION

We propose that successful implementation of the MPAI-4 requires an iKT approach with active engagement from all stakeholders, including managers and clinicians in each of the participating clinical rehabilitation programs. This study has the potential to contribute to the advancement of the knowledge regarding the implementation of the MPAI-4 by examining similarities and differences between sites, highlighting the influence of context in the success of implementation (or not) that may influence the providers' experiences. The combination of multiple theoretical frameworks offers the opportunity to map the broad barriers and enablers influencing clinicians' adoption of MPAI-4, and to select tailored strategies and to comprehensively measure the implementation processes and outcomes, including clinician's perceived clinical utility of MPAI-4 [70], as well as, strategies that will increase the success of the MPAI-4's implementation in the stroke rehabilitation programs.

The implementation process of the MPAI-4 will provide us with data to facilitate communication between clinical teams across the care continuum. It will strengthen patient-centered practice and improve patient outcomes with the goal of optimizing social participation. This study will enhance the clinical utility of the MPAI-4 in stroke. Ultimately, we will conduct a comparison of our results on determinants with those of previous studies conducted with traumatic brain injury patients [22, 30, 89].

Results of this study will provide insights about iKT approach within stroke rehabilitation settings that could be applied to future research projects.

Despite the valuable insights that may be gained from this study, there are some limitations. Mixed methods are useful to address complex research problems that require several data sources such as self-reported questionnaires, patient charts, interviews and focus groups. However, self-reported data collection methods and focus groups may introduce response bias, either as an under or an overestimation of the expected behavior and social desirability. To overcome these challenges and potential biases, we will use triangulation across data sources, various theoretical applications, different methods of analysis and clinical teams' involvement to increase the in-depth understanding of our data and mitigate their potential impacts [90]. To overcome these challenges/bias, we will use triangulation across data sources, various theoretical applications, different methods of analysis and clinical teams' involvement to increase the in-depth understanding of our data and mitigate their potential impacts.

**Ethics and dissemination**

The project has received the Institutional Review Board (IRB) approval of CRIR (CRIR 1523-0221/MP-50-2022-968). Any protocol modifications will be submitted for approval to the IRB, prior to the implementation. The project will be conducted from 2021 to 2024.

The dissemination plan will be developed with the implementation team in each site. The iKT approach (participatory approach, reflective approach, local team) will allow for ongoing knowledge exchange within and between participating sites. In addition, we will disseminate results in peer-reviewed publications and at local, national, and international scientific conferences/workshops. Reporting of this study will seek to satisfy the standards of Good Reporting of a Mixed Methods Study [91] and the Standards for Reporting Implementation Studies [92, 93].

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**Figure 1: Implementation design and Timeline of MPAI implementation project**

**Figure 1: Implementation design and Timeline of MPAI-4 implementation project**